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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/521,356	08/08/2005	Milo Sebastian Peter Shaffer	011765-0314577	9306

909 7590 07/09/2008

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EXAMINER

VETTER, ROBERT A

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

07/09/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/521,356

Applicant(s)

SHAFFER ET AL.

Examiner

ROBERT VETERE

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 January 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SD/US)
Paper No(s)/Mail Date 1/05/7/05
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-2, 6-13, 18-19, 21 and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Resasco et al. (US 6,333,016).

Claims 1-2, 6-9, 12-13, 18-19 and 26: Resasco teaches a method of producing carbon nanotubes comprising the steps of: coating carrier particles, such as silica and alumina (5:30-35) with a thermally decomposable catalyst, such as a bimetal catalyst comprising cobalt and molybdenum (4:52-65; 5:25-30), decomposing the metal salt catalyst to yield carrier particles coated with the catalyst (5:25-30), flowing a carbon-containing gas, such as methane, acetylene or CO, over the particles (5:50:61) to yield nanotubes (5:62-6:18), such as single walled nanotubes (6:7-18) and collecting the formed nanotubes (6:7-18).

Claims 10-11: Resasco also teaches that the carbon source gas contains a diluent gas, such as argon (5:60-61).

Claim 21: Resasco also teaches that the process is continuous (5:67).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 3, 15-17 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco in light of Tennent et al. (US 5,165,909).

Claims 3 and 24: Tennent teaches a method of forming carbon nanotubes (Abst.) comprising the steps of forming a catalyst from a decomposable metal salt, such as an oxalate (8:1-10), decomposing the metal salt to form the catalyst (8:1-10), flowing a carbon source gas, such as methane or acetylene (7:36-53) comprising argon as a diluent (7:54-65) over the catalyst to form carbon nanotubes (Abst.). The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Because both Tennent and Resasco teach methods of forming nanotubes by flowing methane or acetylene over a decomposed metal salt catalyst, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used an oxalate salt, as taught by Tennent, in the method of Resasco with the predictable expectation of success.

Claims 15-17: Tennent also teaches that the temperature at which the metal salt is decomposed varies from about 500°C to about 950°C, depending on the carbon source gas used, and can be as high as about 1200°C (8:1-10; 8:59-9:7).

5. Claims 4-5 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco in light of Unger (DE 10043891).

Claims 4-5 and 24: Unger teaches a method of forming carbon nanotubes using a catalyst and explains that the metal salt can contain (alkyl)cyclopentadienyl or carbonyl groups (Abst.). Resasco teaches that a metal salt containing a (alkyl)cyclopentadienyl group is used (5:25-30). The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have replaced the metal salt containing a (alkyl)cyclopentadienyl group with one containing a carbonyl group, as taught by Unger, in the method of Resasco with the predictable expectation of success.

6. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco in light of Lieber et al. (US 5,997,832).

Claim 14: Resasco teaches the use of alumina or silica as the carrier particles, but fails to expressly teach whether they are in the form of fumed powders. Lieber teaches a method of forming

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carbon nanotubes wherein a carrier particle, such as fumed alumina, is coated with a metal catalyst (2:45-58; 5:29-46) and a hydrocarbon source gas (2:37-44) is reacted with the catalyst to form carbon nanorods (see, e.g., 5:12-18). The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Because both Resasco and Lieber teach substantially similar methods of forming carbon nanotubes and because Resasco is silent regarding the form of the alumina carrier particles, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used fumed alumina powder as the carrier particles, as taught by Lieber, in the method of Resasco with the predictable expectation of success.

7. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco in light of Resasco et al. (US 6,955,800, hereinafter "Resasco II").

Claim 20: Resasco II teaches a method of forming carbon nanotubes wherein catalytic particles are exposed to a carbon source gas to form the nanotubes (3:59-4:19). Resasco II explains that the carrier particles are impregnated with the catalytic metal compound. Resasco I, however, also teaches that zeolites can be used as the catalyst material (5:30-:35), which are highly porous and usually used to impregnate porous structures. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have impregnated the carrier particles with the catalyst, as taught by Resasco II, in the method of Resasco in order to have improved the economy of the nanotube forming process.

8. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco in light of Tennent et al. (US 5,578,543, hereinafter "Tennent II") and further in light of Kawakami et al. (US 2003/0086859).

Claim 22: Resasco teaches all the limitations of claim 22, except that it fails to expressly teach that the substrate particles are fluidized. Resasco does teach that the particles are exposed to a stream of inert gas within the reaction vessel before being exposed to the carbon source (8:35-53). Tennent II,

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however, teaches a method of forming nanotubes by reacting a carbon source gas with catalyst coated particles wherein the particles are fluidized during the continuous reaction (6:26-60). With respect to the limitation that the particles are collected by elution, Kawakami explains that elution is a technique known to those of ordinary skill in the art for collecting nanoparticles (§ 0162, e.g.). Thus, even if the teaching of Resasco does not constitute fluidizing the particles, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have fluidized the particles during the reaction with the predictable expectation of success because both the method of Resasco and Tennent II contain the same steps. Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have collected the nanoparticles by elution because elution is well known in the art at the time of the invention as a means for collecting nanoparticles with the predictable expectation of success.

9. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco and Tennent II in light of Kohlen et al. (US 6,290,775).

Claim 23: Resasco and Tennent II teach all the limitations of claim 23 except that the reaction occurs on an inclined surface. Kohlen explains that it is well known in the art that a fluidized bed reactors can be arranged vertically or at an angle (1:20-23). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have arranged the fluidized bed reaction of the combined method of Resasco and Tennent II on an incline, as taught by Kohlen, with the predictable expectation of success because it is well known in the art to use an inclined fluidized bed for a reaction.

10. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco and Unger in light of Kawakami.

Claim 25: Resasco and Unger fail to teach that the catalyst is formed from nickel formate. Kawakami teaches a method of forming nanotubes (Abst.) using nickel formate instead of nickel carbonyl as the catalyst (§ 0078). The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used nickel formate in the method of Resasco and Unger with the predictable expectation of success.

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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT VETERE whose telephone number is (571)270-1864. The examiner can normally be reached on Mon-Fri 9-6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Robert Vetere/
Examiner, Art Unit 1792

/Michael Cleveland/
Supervisory Patent Examiner, Art Unit 1792